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THE GENUS *TRECHUS* (COLEOPTERA: CARABIDAE: TRECHINI) IN THE SOUTHERN APPALACHIANS¹

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The carabid fauna of the southern Appalachians has been characterized by Darlington (1943) as incompletely known, but well sampled. Like other mountain faunas it has comparatively few species, most of them geophiles and "more than half of all species, and a large majority of geophiles alone" are effectively wingless. It is a fauna which has been formed by "elimination and concentration, but with some later multiplication of species" in wingless stocks.

Among the more abundant, wingless geophiles are the species of the genus *Trechus* Clairville. The *Trechus* of the southern Appalachians are small (2.4-5.0 mm.), wingless geophiles restricted to cool, moist microhabitats. All are black or pale piceous and shining, either highly polished or (usually) with finely alutaceous microsculpture. Jeannel (1927, 1931) recognized 5 species from western North Carolina—*T. carolinae* Schaeffer, *T. schwarzi* Jeann., *T. beutenmulleri* Jeann., *Microtrechus vandykei* Jeann., and *M. barberi* Jeann. Although the species belonging to *Microtrechus* are readily distinguishable on the basis of the male protarsus (only one segment enlarged instead of two as in *Trechus*), and although they form a geographically compact group (as will be demonstrated), I do not believe

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that the retention of *Microtrechus* as a full genus serves any useful taxonomic purpose, based as it is on a single character. Accordingly, in the present paper, I have reduced *Microtrechus* to subgeneric status.

Methods and Scope.—In June and September, 1959, preliminary collections were made on Roan Mountain, Carter Co., Tenn.-Mitchell Co., N.C.; Grandfather Mountain, Avery Co., N.C.; Mt. Mitchell, Yancey Co., N.C.; and Clingmans Dome and Mt. Collins, Sevier Co., Tenn.-Swain Co., N.C. During July and August, 1960, M. C. Bowling and I collected approximately 1500 *Trechus* from about 50 localities between White Top Mountain, Grayson Co., Virginia, and Rabun Bald, Rabun Co., and Brasstown Bald, Union Co., Georgia. A few additional collections were made in the Great Balsam and Smoky Mountains in May, 1961. Other specimens, primarily from caves, were obtained from the adjacent Appalachian valley and Cumberland plateau. In this paper no attempt has been made to treat species of *Trechus* outside this area. The beetles were taken by hand and preserved in Barber's fluid, degreased in ether, and pointed. Male genitalia were dissected from nearly 200 specimens and permanently cleared and mounted in Down's medium by the method I have described elsewhere (Barr 1961). Measurements were taken with a calibrated ocular micrometer, and drawings of the cleared genitalia were made with a camera lucida. The following abbreviations are employed: TL total length, HL head length, HW head width, PL pronotum length, PW pronotum width, EL elytra length, EW elytra width, ANT antenna length. All lengths are measured along the mid-line, and all widths are maximum widths; the head length is measured from the anterior margin of the labrum. All measurements are given in millimeters.

Holotypes have been deposited in the U. S. National Museum.

GEOGRAPHY

The many chains of the southern Appalachians are difficult to define. There are at least six major massifs of special importance to the present discussion because of the species of *Trechus* which occur in them. Their precise location and topography may be ascertained by examination of small-scale topographic maps, such as the Army Map Service 1:250,000 series (NJ 17-10 Johnson City, NJ 17-11 Winston-Salem, NI 16-3 Chattanooga, and NI 17-1 Knoxville).

Roan Mountains. A short chain, along the border between Carter Co., Tennessee, and Mitchell Co., North Carolina. "Roan Mountain" itself is readily accessible by paved U.S. Forest Service road; its highest point, Roan High Bluff, has an elevation of 6313 feet.

Black and Great Craggy Mountains. These two *en echelon* chains in Yancey and Buncombe counties, North Carolina, extend north and south, in contrast to the general northeast-southwest strike of most of the Appalachians. For zoogeographical purposes, they may be considered a single unit. Both ranges contain several peaks over 6000 feet in elevation, and Mt. Mitchell, in the Blacks, is the highest point in eastern America, with an elevation of 6684 feet. The Blacks and Craggies are readily accessible by the Blue Ridge Parkway and the road into Mt. Mitchell State Park.

Great Balsam Mountains. A U-shaped chain, south of Waynesville and Canton, along the Haywood-Transylvania and Haywood-Jackson County boundaries, North Carolina. The eastern arm, terminating in Mt. Pisgah (el. 5721 feet), is sometimes called "Pisgah Ridge," or in older usage, "Pisgah Ledge." The western arm includes the highest peaks, many over 6000 feet, with a maximum elevation of 6370 feet at the summit of Richland Balsam. To the north, between Lickstone Ridge and Cold Mountain, the range is deeply cleft by the West Fork of Pigeon River, along which lies the settlement of Retreat, given as type locality for *Microtrechus barberi* Jeann. and as a locality record for *Trechus schwarzi* Jeann. "Pisgah Ledge" is readily accessible via the Blue Ridge Parkway, and the section of the Parkway from Beech Gap to Balsam Gap, through the western arm of the Balsams, is now under construction.

Plott Balsam Mountains.—The Plott Balsams are a short range separating the Great Balsams and Great Smokies, and extend northeast-southwest from Waynesville to Sylva, in Haywood and Jackson Counties, North Carolina. The highest point, Water Rock Knob, has a summit elevation of 6292 feet. The Plott Balsams are readily accessible via a newly completed segment of the Blue Ridge Parkway; more remote portions, such as Junaluska Balsam (=Jones Knob), can be reached on foot by logging road.

Great Smoky Mountains.—Extending for more than 50 miles along the Tennessee-North Carolina border, the Great Smokies, by their massive size and extent, aptly deserve Arnold Guyot's appellation of "Citadel" of the Appalachians. The highest point is Clingman's Dome (el. 6642 feet). The Canadian spruce-fir forest characteristic of high elevations throughout most of the Appalachians reaches its southernmost extension in the Smokies. The entire chain, including a southward extension at the east end ("Balsam Mountain"), lies within Great Smoky Mountains National Park. At the northwest boundary of the Park, *Trechus* occurs in caves developed in the Knox dolomite where it is exposed in windows in the Great Smoky Mountains thrust sheet.

Unicoi Mountains.—This range separates Monroe Co., Tennessee, and Graham Co., North Carolina, and has a length of approximately 20 miles. The highest peak, Haw Knob, has an elevation of 5500 feet. The Unicoi Mountains are accessible by primitive U. S. Forest Service road from Tellico Plains on the Tennessee side, or by foot trail from Joyce Kilmer Memorial Forest in North Carolina.

ECOLOGY

The most striking observation made about the ecology of the species of *Trechus* studied in this investigation is their rigid restriction to cold, wet microhabitats. Except for the cave and sinkhole species, only three specimens were collected at altitudes below 4500 feet. Two individuals, both females but each of a different species not determinable with certainty, occurred along Little River two miles upstream from Elkmont, Sevier Co., Tennessee, at an elevation of 2300 feet. A single male *T. barberi* was taken in the gorge below Whitewater Falls, Jackson Co., North Carolina, at an elevation of 2400 feet. Both localities are kept cold and damp by the proximity of mountain streams.

The summits and north and northwest faces of the mountains, on the side toward the prevailing winds, are generally much more favorable *Trechus* localities, and appear to be consistently colder and damper. The westernmost ranges—Roan Mountain, the Bald Mountains, the Great Smokies, and the Unicoi Mountains—are damper and have a more luxuriant moss flora, which facilitates the collection of *Trechus*. Most of the large series, and almost all of the local endemics, were collected within or near the edge of the Canadian forest of red spruce (*Picea rubens*) and Fraser fir (*Abies fraseri*), which extends southward to the Great Balsams, Plott Balsams, and eastern two-thirds of the Great Smokies.

The two primary substratum requirements of a montane *Trechus* microhabitat appear to be contact with a rock surface and the presence of rich humus or duff. A majority of species thus are found under carpets of moss, on rock ledges, boulders, and low cliffs. The moss must be light and spongy, retaining moisture readily, yet insuring good drainage and aeration. The species of *Hylocomium*, which have feathery leaves, are ideally suited, since they form compact, light, airy, damp mats which may be several square yards in area. Roots of trees, various small angiosperms, and occasional ferns and other mosses provide local variability in the composition of the *Hylocomium* mats. When such a mat is rolled back from the boulder or rock outcrop it covers, a characteristic moss mat arthropod fauna is observed scurrying across the rock surface or struggling in the moss rhizoids. In addition to *Trechus*, the common components are earthworms, pseudoscorpions (esp. *Neobisium carolinense*), spiders, mites (chiefly predatory species, but oribatids are locally numerous), millipedes, centipedes (esp. geophilomorphs), symphylans, collembolans, diplurans (esp. japygids), and beetles of the families Staphylinidae and Pselaphidae (genera *Batrisodes*, *Batriasymmodes*, and rarely *Arianops*). Other carabids are not uncommon, especially *Bembidion* (*Amerizus*) *oblongulum* Hbst., *Pterostichus adoxus* (Say), *Agonum hypolithum* (Say), *A. trifoveolatum* (Beut.), and various Cychrini (*Sphaeroderus canadensis* Chd., *Sph. multicarinatus* Darl., *Scaphinotus andrewsi* Harris, *Sc. tricarinatus* Csy., *Sc. viduus irregularis* Beut., and various small, endogenous *Scaphinotus* of the subgenus *Maronetus* Csy.). Plethodontid salamanders are sometimes encountered, and include *Desmognathus ochrophaeus carolinensis* Dunn, *D. wrighti* King, *Plethodon jordani* subsp., and *Eurycea bislineata wilderae* Dunn. *Trechus* larvae, apparently of *beutenmulleri*, were taken from an extensive moss mat on Roan Mountain. Within the moss mat community there are thus numerous potential food species as well as many potential predators, as far as *Trechus* is concerned.

Other species of mosses form less suitable mats. Those of *Polytrichum* spp. and *Dicranium* spp. are too dense, and those of *Sphagnum* spp. too wet and poorly aerated. The mats formed by *Thuidium* spp. usually retain moisture poorly, but in ravines or on shady summits will sometimes harbor a typical mat fauna, including *Trechus*.

Accumulations of forest floor duff, lightly bound together by rootlets, can serve a function similar to that of the moss carpets. Such accumulations seem especially favorable where piled against the base of wet, vertical, or steeply sloping rock faces. The top 10 to 25 cm can usually be pushed

back with a small trowel or other collecting tool, and the *Trechus* are then found walking across the rock.

The temperature of the moss and duff mats sampled ranged between 13°-18° C. in July and August, 1960, with a mean of about 14°. Mat temperatures are directly related to circumambient air temperatures, but apparently fluctuate more slowly, within narrower limits, probably because of the insulating effect of the adjacent rock.

Certain species of *Trechus* are more commonly found in loose piles of rock fragments and black, podzolic humus and rootlets, especially in gullies and on low banks in seepage areas at high altitudes. Two species with small eyes and pale coloration belong in this category. One species, *T. beutenmulleri*, although restricted to altitudes above 5000 feet, ranges through many microenvironments, occurring under moss, under rocks in ravines, under and inside rotting logs, and in spruce and fir needle duff.

The cave and sinkhole *Trechus* exist in an environment of high relative humidity and nearly constant temperature (13°-15° C.). The species described from the Cumberland plateau was on one occasion found in a strictly epigeal locality—in a deep gorge, among wet rocks at a cold spring, at 16°.

TAXONOMY

KEY TO TRECHUS OF THE SOUTHERN APPALACHIANS AND CUMBERLAND PLATEAU (MALES ONLY)

- 1. Males with first and second segments of front tarsus enlarged -----
-----Subgenus **TRECHUS** s.str. 2
- Males with first segment only of front tarsus enlarged -----
-----Subgenus **MICROTRECHUS** Jeannel 3
- 2(1). Aedeagus unusually elongate, the apex produced, attenuate, more or less inflected before the tip; left copulatory piece rod-like and half as long as the spatulate, marginally serrulate right piece within which it lies; internal sac armed with very small scales and provided with a dorsal, wing-like extension (fig. 1-5)-----
-----**HYDROPICUS** group 5
- Aedeagus large, long and slender, strongly arcuate in left lateral view, the apex curved strongly to the left in dorsal view; left copulatory piece rod-like, almost as long as the spatulate right piece, both pieces usually with serrated margins; internal sac armed with scales, but without a wing-like extension (figs. 6-9)
-----**CAROLINAE** group 8
- 3(1). Aedeagus more or less strongly arcuate, the apex gradually attenuate, the tip usually slightly rounded and reflexed but never hooked; internal sac with very small or moderate scales ----- 4
- Aedeagus provided with an apical hook, the apex more or less produced (figs. 16-20); internal sac armed with large, prominent scales (except in one species)-----
-----**UNCIFER** group 15
- 4(3). Size smaller (2.4-3.3 mm.); scutellar stria of elytra obsolete; transfer apparatus of two lightly sclerotized, lamellar copulatory pieces, the left small and triangular, the right large and apically rounded; internal sac armed with very small, indistinct, blunt or apiculate scales, sparsely set (figs. 11-15)-----**VANDYKEI** group 11
- Size larger (3.3-5.0 mm.); scutellar stria of elytra well developed (except in one large species); transfer apparatus of two variable copulatory pieces, but always heavily sclerotized and unusually large and prominent; internal sac armed with medium-sized scales, thickly set in oblique rows, blunt toward the base of the sac and apiculate near the apex (figs. 21-27)-----**NEBULOSUS** group 19
- 5(2). Size smaller (2.7-3.5 mm.); pronotum 1/2 wider than long; first discal puncture behind level of 4th marginal humeral puncture; Grayson Co., Virginia, southwestward to Buncombe Co., N.C.-----**BEUTENMULLERI** 6

- Size larger (3.8-4.4 mm.); pronotum $\frac{1}{3}$ wider than long; first discal puncture at level of 3rd marginal humeral puncture; known only from Roan Mountain, Tenn.-N.C.
-----**ROANICUS** n. sp.
- 6(5). Apex of aedeagus knobbed or conspicuously inflected ----- 7
Apex of aedeagus simply attenuate, only slightly inflected (fig. 2); Carter Co., Tenn., southwestward to Buncombe Co., N.C. --- **BEUTENMULLERI BEUTENMULLERI** Jeannel
- 7(6). Apex of aedeagus bearing a small but prominent knob (fig. 3); Ashe Co. to Avery Co., N.C. -----**BEUTENMULLERI AVUS** n. subsp.
Apex of aedeagus not knobbed but conspicuously inflected (fig. 4); Grayson Co., Va.--
-----**BEUTENMULLERI CANUS** n. subsp.
- 8(2). Size small (3.4-4.2 mm.); elytra $\frac{7}{10}$ to $\frac{3}{4}$ as wide as long, subconvex; pronotum $\frac{1}{3}$ to $\frac{2}{5}$ wider than long ----- 9
Size large (4.4-4.8 mm.); elytra $\frac{4}{5}$ as wide as long, very convex; pronotum only $\frac{1}{4}$ wider than long; known only from the summit of Mt. Mitchell, N.C. -----
-----**CAROLINAE** Schaeffer
- 9(8). Apex of aedeagus attenuate, the apical knob rounded ----- 10
Apex of aedeagus not appreciably attenuated, the apical knob with a sharp ventral carina (fig. 8); Black Mountains and adjacent ranges, N.C. --- **MITCHELLENSIS** n. sp.
- 10(9). Apical knob of aedeagus larger (fig. 7); right copulatory piece not apically truncate; Great Balsam, Great Craggy, and Black Mountains, N.C. ----- **SCHWARZI** Jeannel
Apical knob of aedeagus smaller (fig. 9); right copulatory piece apically truncate; Cumberland plateau of Tenn. and Ky.----- **CUMBERLANDUS** n. sp.
- 11(4). Size smaller (2.4-2.9 mm.); pronotum nearly $\frac{1}{2}$ wider than long ----- 12
Size larger (2.8-3.3 mm.); pronotum about $\frac{2}{5}$ wider than long ----- 13
- 12(11). Sides of pronotum arcuate to basal sinuosity; aedeagus (fig. 11) smaller (0.43-0.48 mm.); Greene Co., Tenn., to Jackson Co., N.C., exclusive of Great Smoky Mountains; common-----**VANDYKEI** Jeannel
Sides of pronotum arcuate only in apical half, then convergent to the obtuse, almost rounded hind angles; aedeagus (fig. 12) larger (0.65-0.70 mm.); known only from Great Smoky Mountains ----- **BOWLINGI** n. sp.
- 13(11). Aedeagus smaller (0.64-0.82 mm.); head as wide as long; antenna slightly less than half the body length----- 14
Aedeagus (fig. 15) larger (0.85-0.92 mm.); head slightly wider than long; antenna $\frac{3}{5}$ the body length; known only from Haywood Co., N.C. -----**SUBTILIS** n. sp.
- 14(13). Aedeagus (fig. 14) slender, broadly inflected before the apex; apex of pronotum $\frac{1}{10}$ wider than base; apical recurrent groove elongate, laterally inflected, usually curved at anterior end; known only from Thunderhead Mountain, Blount Co., Tenn.-----**TONITRU** n. sp.
Aedeagus (fig. 13) thicker, gradually attenuate and not inflected; apex and base of pronotum subequal; apical recurrent groove short, not inflected, oblique to suture; mountain region of Tenn., N.C., and Ga. south of French Broad River; common --
-----**BARBERI** Jeannel
- 15(3). Size smaller (2.7-3.5) mm.); internal sac of aedeagus armed with conspicuous, apiculate scales ----- 16
Size larger (3.6-4.0 mm.); internal sac of aedeagus armed with small spines only; eyes small, integument pale piceous; Great Smoky Mountains -----**VERUS** n. sp.
- 16(15). Head rounded, its length and width subequal; aedeagus smaller (0.66-1.03 mm.), $\frac{1}{3}$ the body length or less----- 17
Head slightly transverse, $\frac{1}{12}$ wider than long; aedeagus (fig. 17) very large (1.47-1.49 mm.), about 0.45 the body length; Great Balsam Mountains **SATANICUS** n. sp.
- 17(16). Aedeagus smaller (0.66-0.81 mm.); apex only slightly produced, the apical hook broadly rounded and reflexed----- 18
Aedeagus (fig. 16) larger (0.88-1.03 mm.), apex abruptly narrowed and greatly produced, the apical hook a sharp, reflexed barb; scales of internal sac extremely large and prominent, totally obscuring transfer apparatus; Great Smoky Mountains and Plott Balsam Mountains----- **UNCIFER** n. sp.
- 18(17). Size larger (3.1-3.4 mm.); aedeagus (fig. 19) larger (0.79-0.81 mm.); eye diameter equal to length of scape; Great Balsam Mountains, N.C.-----**ADUNCUS** n. sp.
Size smaller (2.7-3.0 mm.); aedeagus (fig. 20) smaller (0.66-0.73 mm.); eye diameter about $\frac{8}{10}$ length of scape; Unicoi Mountains-----**TALEQUAH** n. sp.
- 19(4). Size smaller (3.3-4.3 mm.); in mountains or in caves----- 20
Size larger (4.3-5.0 mm.); known only from mountain peaks over 6000 feet in elevation ----- 25

- 20(19). Right copulatory piece of aedeagus twisted into the shape of a bird's head (fig. 21); margins of pronotum not sinuous; hind angles large, blunt, obtuse, and reflexed; known only from high conifer forests in Great Smoky Mountains----**NEBULOSUS** n. sp.
Right copulatory piece not as described; margins of pronotum with basal sinuosity; hind angles small, sharp, subquadrate, acute----- 21
- 21(20). Color pale, reddish-piceous; eyes small (about 0.15 mm.); longitudinal striation of elytra fairly well developed, with inner 5 or 6 striae complete; known only from caves and sinkholes in East Tennessee----- 22
Color black to dark piceous; eyes large (0.20-0.24 mm.); external elytral striae obsolescent; intervals with faint rows of micropunctures; known only from high altitudes in the Plott Balsam, Great Smoky, and Unicoi Mountains----- 24
- 22(21). Aedeagus (fig. 22) smaller (0.85-0.90 mm.); anterior discal puncture of elytra placed anterior to the 4th marginal humeral puncture; hind angles of pronotum subquadrate; right copulatory piece $\frac{1}{3}$ longer than left piece, apically rounded and enlarged; Tuckaleechee Caverns, Blount Co., Tenn.-----**TUCKALEECHEE** n. sp.
Aedeagus (fig. 23) larger (1.02-1.07 mm.); anterior discal puncture at the level of the 4th marginal humeral puncture; hind angles of pronotum acute; copulatory pieces subequal, slender, and strongly arcuate-----**TENNESSEENSIS** n. sp. 23
- 23(22). Clypeus with a pair of small grooves internal to extension of frontal grooves onto clypeus; labrum singly emarginate; known only from Berry Cave, Roane Co., Tennessee-----**TENNESSEENSIS** s. str.
Clypeus without internal grooves; labrum doubly emarginate; known only from sinkhole outside Bull Cave, Blount Co., Tenn.-----**TENNESSEENSIS TAURICUS** n. subsp.
- 24(21). Aedeagus (fig. 24) larger (0.93-1.05 mm.); size smaller (3.6-3.9 mm.); margins of pronotum sinuate only briefly, in basal $\frac{1}{20}$; Plott Balsam Mountains, N.C.--
-----**BALSAMENSIS** n. sp.
Aedeagus (fig. 25) smaller (0.63-0.73 mm.); size larger (3.7-4.4 mm.); margins of pronotum sinuate in basal $\frac{1}{9}$ or $\frac{1}{10}$; Great Smoky Mountains and Unicoi Mountains-----**LUCULENTUS** n. sp.
- 25(19). Form convex, larger (4.5-5.0 mm.); color black; margins of pronotum with shallow sinuosity in basal $\frac{1}{10}$; scutellar stria present; right copulatory piece of male transfer apparatus expanded, hatchet-shaped, $\frac{1}{5}$ longer than from left piece (fig. 26); Plott Balsam and Great Balsam Mountains, N.C.-----**ROSENBERGI** n. sp.
Form subdepressed, smaller (4.2-4.7 mm.); color pale piceous; margins of pronotum not sinuous; scutellar stria obsolete; both copulatory pieces extremely slender and elongate, the right piece only slightly longer than the left, both pieces subequal in width (fig. 27); known only from Clingmans Dome in Great Smoky Mountains--
-----**NOVACULOSUS** n. sp.

SUBGENUS *TRECHUS* S. STR.

HYDROPICUS GROUP

Length 2.7-4.4 mm. Integument dark piceous, shining; legs and palps pale piceous. *Head* rounded or slightly wider than long; labrum emarginate; eyes moderately convex, their diameter equal to or slightly less than length of scape; antennae half body length or less. *Pronotum* transverse, $\frac{1}{3}$ to $\frac{1}{2}$ wider than long; hind angles moderate to large. *Elytra* $\frac{3}{4}$ as wide as long, convex; longitudinal striae feeble, the inner 4 or 5 complete and external striae obsolescent; apical recurrent groove rather short, arcuate, then subparallel to suture, entering 5th longitudinal stria at or before level of the apical discal puncture; anterior discal puncture at or before level of the 4th marginal humeral puncture. *Aedeagus* unusually elongate, apex drawn out, attenuate, more or less inflected before tip, which may be slightly knobbed or not; left copulatory piece rod-like and half as long as spatulate, marginally serrulate right piece within which it lies; internal sac armed with very small scales and provided with a dorsal, wing-like process.

Type-species: *T. hydropicus* Horn.

I have more closely circumscribed this species group than Jeannel (1931) did, removing *carolinae*, *schwarzi*, and their relatives. *Trechus hydropicus* is a poorly known species whose type locality is simply "Va." In the U.S. National Museum is a broken male, collected by Ulke, which is probably part of the original type series. I have seen a few other spec-

imens from "Virginia," "West Virginia," and "Maryland," which apparently are conspecific, but it is impossible to define the range of *hydropicus* from such inadequate material. It is probably distributed through the northwestern part of Virginia and adjacent ranges of the Appalachians in West Virginia, Maryland, and perhaps Pennsylvania, but extensive collecting is required to establish this. The aedeagus of the Ulke specimen (fig. 1) is so similar to that of *beutenmulleri* that the two species are undoubtedly closely related, perhaps geographic variants of an abundant, wide-ranging polytypic species. But *hydropicus* as currently defined does not occur within the area covered by the present study, and I am reluctant to alter Jeannel's (1931) arrangement without better material.

Trechus (*T.*) *beutenmulleri beutenmulleri* Jeannel [NEW STATUS]
(FIG. 2)

Trechus Beutenmulleri Jeannel 1931: 436. Type: Mt. Mitchell, N.C. (Mus. Nat. Hist. Nat., Paris).

T. hydropicus: Schaeffer 1901: 212, pl. 28, fig. 4; Casey 1918: 410; Jeannel 1927: 191, fig. 589-591.

Similar to *hydropicus* Horn, differing in the more elongate head, more transverse pronotum, and more convex elytra.

Length 2.7-3.5, mean 3.0. Dark piceous, form short, robust and convex. *Head* about as long as wide; eyes moderately convex, their diameter (0.16) slightly less than length of scape; antenna less than half (0.45) body length. *Pronotum* 1/2 wider than long; apex 9/10 of base width, and base width 3/4 of maximum width, which occurs in apical 1/3; margins arcuate in apical 1/2, then convergent to brief basal sinuosity; hind angles small, rounded, and right; basal foveae short and linear, separated from the marginal gutter by a low ridge. *Elytra* 3/4 as wide as long, convex; inner four longitudinal striae complete, outer striae obsolescent or obsolete; apical recurrent groove subparallel to suture at anterior end, running into 5th longitudinal stria in advance of apical discal puncture; first discal puncture behind level of the 5th marginal humeral puncture. *Aedeagus* 0.80-0.94, mean 0.87; elongate, the basal bulb large and deflexed, with a slight inflection just before apex; copulatory pieces very elongate, the left rod-like and half as long as the curved, spatulate right piece within which it is nested; margins of both pieces serrulate; internal sac armed with very small, sparsely scattered scales, and provided with a wrinkled, membranous, dorsal, wing-like process apparently characteristic of the species group; parameres elongate, with 4 long setae.

Topotype male (Mt. Mitchell, in author's collection): TL 3.48, HL 0.73, HW 0.71, PL 0.67, PW 1.02, EL 2.08, EW 1.55, ANT 1.55.

Distribution: NORTH CAROLINA: Mt. Mitchell, Yancey Co.; Roan Mountain, Mitchell Co.; Craggy Dome and Balsam Gap, Buncombe Co. TENNESSEE: Roan Mountain, Carter Co.; Unaka Mountain, Unicoi Co.; Camp Creek Bald, Greene Co. The range thus extends southwestward from Roan Mountain through the Bald Mountains along the Tennessee-North Carolina border and eastward to the Black and Great Craggy Mountains to the edge of the Blue Ridge.

Trechus (*T.*) *beutenmulleri avus* NEW SUBSPECIES
(FIG. 3)

Similar in all respects to *beutenmulleri* s. str. except that the apex of the aedeagus bears a small but very distinct knob instead of being simply attenuate.

Holotype male (U.S.N.M. 65973) and numerous paratypes, Grandfather Mountain, Avery Co., North Carolina, 22 Aug. 1960 (TCB/MCB); additional paratypes from Grandfather Mountain, June, 1959, and from Three Top Mountain, Ashe Co., N.C., August, 1960. Known only from these two localities, which are about 25 miles apart along the Blue Ridge.

Trechus (T.) b. beutenmulleri X *beutenmulleri avus*

A series of 14 *beutenmulleri* from near the summit of Beech Mountain, at Banner Elk, Avery Co., N.C., exhibits aedeagal characteristics intermediate between the nominate race and *b. avus*, and is here regarded as a case of intergradation. The series includes specimens with both the *beutenmulleri* and *avus* aedeagal apices, as well as morphological intermediates which have a rather blunt, rounded, but not enlarged apex. Geographically, Beech Mountain is 7 miles north of Grandfather Mountain and 15 miles northeast of Roan Mountain.

Trechus (T.) beutenmulleri canus NEW SUBSPECIES

(FIG. 4)

Distinguished from *b. beutenmulleri* and *b. avus* by the character of the aedeagal apex, which is thickened and more sharply inflected, but does not bear a distinct knob.

Holotype male (U.S.N.M. 65974) and 33 paratypes, White Top Mountain, Grayson Co., Virginia, 18 July 1960 (TCB/MCB). Known only from the type locality, which is 17 miles north and a little west of Three Top Mountain.

Trechus (T.) roanicus NEW SPECIES

(FIG. 5)

A large species of the *hydropicus* group, readily distinguished from *beutenmulleri* by its larger size and by the position of the anterior and apical discal punctures of the elytra.

Length 3.8-4.4, mean 4.1. Dark piceous, shining, rather convex and robust. *Head* 3/20 wider than long; labrum deeply emarginate; eye diameter 0.20, 1/4 head length and subequal to length of scape; antenna half total body length. *Pronotum* 1/3 wider than long; base 1/8 wider than apex; width of base 3/4 maximum width, which occurs at apical 1/4; margins rounded apical 3/4, gradually becoming subparallel in basal 1/4; hind angles large and right. *Elytra* convex, 3/4 as wide as long; longitudinal striation feeble, with inner 5 striae complete and outer striae obsolete; apical recurrent groove short, running into 5th longitudinal stria at level of apical discal puncture, which is placed rather close to apical margin; anterior discal puncture at level of 3rd marginal humeral puncture. *Aedeagus* 1.14-1.26, similar to that of *beutenmulleri* but larger; apex slightly knobbed; parameres with 4 long setae.

Holotype male (U.S.N.M. 65977) and 34 paratypes, Roan Mountain, Carter Co.; Tennessee, 12 July 1960 (TCB/MCB). *Holotype male*: TL 4.17, HL 0.73, HW 0.84, PL 0.86, PW 1.18, EL 2.58, EW 2.04, ANT 2.04.

Distribution: Known only from the type locality at Roan High Knob (el. 6313 feet) on Roan Mountain.

CAROLINAE GROUP, NEW GROUP

Length 3.4-4.8 mm. Integument dark piceous, often almost black, shining; legs and usually elytral margin pale piceous. *Head* rounded; labrum singly emarginate; eyes

subconvex or convex, their diameter about equal to length of scape; antenna half body length. *Pronotum* transverse, $1/4$ to $2/5$ wider than long; hind angles usually of moderate size (large in *schwarzi*) and somewhat reflexed; basal foveae separated from marginal gutter by a low ridge. *Elytra* $7/10$ to $8/10$ as wide as long, moderately to prominently convex; longitudinal striae feebly impressed, inner 4 always distinguishable, sometimes all striae complete; apical recurrent groove arcuate, short, oblique to suture, running into the 5th longitudinal stria at or a little anterior to level of the apical discal puncture; anterior discal puncture slightly in advance of or at level of 4th marginal humeral puncture. *Aedeagus* large, long and slender, strongly arcuate in left lateral view, apex curved strongly to left in dorsal view and bearing an apical knob, variously modified in different species; transfer apparatus of a rod-like left copulatory piece nested within a broad, sinistrally concave, spatulate right piece, both pieces sometimes with serrulations; internal sac armed with small spines.

Type-species: *T. (T.) carolinae* Schaeffer.

Trechus (T.) carolinae Schaeffer

(FIG. 6)

Trechus carolinae Schaeffer 1901: 212, pl. 28, fig. 5. Type: Mt. Mitchell, N.C. (Am. Mus. Nat. Hist.). Jeannel 1931: 439.

T. carolina: Casey 1918: 409.

Distinguished from all other *Trechus* s. str. in the southern Appalachians by its large size, as well as the proportions of the pronotum and elytra and the aedeagal characteristics.

Length 4.4-4.8, mean 4.6. Pale, reddish-piceous, robust and very convex, shining. *Head* only slightly wider than long; labrum shallowly emarginate; eyes subconvex, equal in diameter (0.22) to length of scape; antenna 0.55 the body length. *Pronotum* $1/4$ wider than long; apex $6/7$ width of base; base width $3/4$ maximum width, which occurs in apical $1/4$; margins arcuate in apical $1/2$, then convergent and rather broadly reflexed to very brief basal sinuosity; hind angles moderate, sharp, and right; basal foveae separated from marginal gutter by low ridge. *Elytra* $4/5$ as wide as long, very convex; longitudinal striae feebly impressed but all of them distinguishable; apical recurrent groove short, arcuate, oblique to suture, continuous with 5th longitudinal stria at level of apical discal puncture; first discal puncture placed before level of 4th marginal humeral puncture. *Aedeagus* 1.13-1.21, mean 1.17; basal bulb large and prominently keeled, apex long, gradually attenuate, its tip slightly knobbed; left copulatory piece rod-like, ventrally and apically serrulate; right piece broad and spatulate, obliquely truncate; internal sac armed with numerous small, apiculate scales; parameres long, with 4 long setae.

Topotype male (Mt. Mitchell, N.C., in author's collection): TL 4.45, HL 0.78, HW 0.82, PL 0.95, PW 1.18, EL 2.72, EW 2.14, ANT 2.46.

Distribution: Known only from the type locality, at the summit of Mt. Mitchell, where it is very rare; on two visits in July and August, 1960, I took only 8 specimens.

Trechus (T.) schwarzi Jeannel

(FIG. 7)

Jeannel 1931: 437. Type: probably from Retreat, Haywood Co., N.C. (U. S. Nat. Mus.).

Trechus hydropicus: Schaeffer 1901: 212 (in part)?

Distinguished from *T. carolinae* by the smaller size, and from all members of the group by the prominent, rounded apical knob of the aedeagus.

Length 3.4-3.8, mean 3.6. Dark piceous, robust, subconvex, shining. *Head* $1/10$ wider than long; eyes rather small, not convex, their diameter (0.20) slightly less than length of scape; antenna half total body length. *Pronotum* $2/5$ wider than long, widest at apical $1/4$, apex $9/10$ width of base; base width $7/10$ maximum width; margins arcuate in apical $9/10$, then subparallel; hind angles large, sharp, and right; basal foveae continuous with basal gutter medially but separated from marginal gutter by a ridge. *Elytra* $3/4$ as wide as long, moderately convex; longitudinal striae feebly impressed, inner striae more prominent but all distinguishable; apical recurrent groove oblique to suture, running into 5th longitudinal stria in advance of apical discal seta; first discal seta at level of 4th marginal humeral seta. *Aedeagus* 1.23-1.38, long and arcuate, basal bulb large and prominently keeled, apex tapered and conspicuously knobbed; left copulatory piece thin and rod-shaped, nested in the broader, spatulate right piece, which has a serrulate margin; internal sac armed with numerous small, apiculate scales; parameres long and slender, with 4 long setae.

Paratype male (Retreat, Haywood Co., N.C., in author's collection): TL 3.84, HL 0.73, HW 0.80, PL 0.78, PW 1.10, EL 2.33, EW 1.78, ANT 1.93.

Distribution: Jeannel (1931, pp. 437-439) gives the type locality as Roan High Knob, (Carter Co.), Tennessee, and records several examples from Retreat, N.C., which he believed was situated in the same region. However, Retreat is located in Haywood Co., N.C., near Lake Logan, some 65 miles southwest of Roan Mountain. More than 150 specimens of *Trechus* taken on Roan Mountain included no examples of *schwarzi* whatever. The U. S. National Museum collection contains a pair of *schwarzi* collected on Mt. Pisgah, near Retreat, by E. R. Quirsfeld (Sept. 1934). My own collections include 18 *schwarzi* from Craggy Dome, Buncombe Co., N. C., and a male from Mt. Mitchell, Yancey Co., N.C. Females from Tusquitee Bald, Clay-Macon Cos., N.C., and Camp Creek Bald, Greene Co., Tenn., may belong to *schwarzi*. It is probable that the entire type series came from Retreat, Haywood Co., N.C., in the surrounding Great Balsam Mountains, and that the "Roan High Knob" label on the type is a curatorial error. The material at hand indicates that *T. schwarzi* ranges from the northeastern edge of the Great Balsam Mountains, in Haywood Co., through the Great Craggy Mountains, Buncombe Co., to the Black Mountains, Yancey Co., N.C.

Trechus (*T.*) *mitchellensis* NEW SPECIES

(FIG. 8)

Superficially similar to *T. schwarzi* Jeann., but readily distinguished by the shorter, less attenuate aedeagal apex, by the sharp ventral carina on the apical knob, and by the differing copulatory pieces.

Length 3.6-4.2, mean 3.7. Dark piceous black, robust and subconvex, shining. *Head* as wide as long; eyes convex, their diameter slightly greater than length of scape; antenna almost half the body length. *Pronotum* $1/3$ wider than long; apex less than $9/10$ width of base; base width equal to pronotum length and $2/3$ maximum width, which occurs in apical $1/3$ a little posterior to anterior marginal setae; margins arcuate in apical $1/2$, then gradually convergent, broadly reflexed but scarcely sinuate before hind angles, which are moderate, sharp, and right. *Elytra* $3/4$ as wide as long, rather convex; inner 4 longitudinal striae feebly developed; outer striae obsolescent; apical recurrent groove oblique to the suture, running into 5th longitudinal stria a short distance in advance of the apical discal puncture; first discal puncture just anterior to 4th marginal humeral puncture. *Aedeagus* 1.21-1.30, mean 1.23; large, arcuate, and rather thick, the apex scarcely attenuate; basal bulb deflexed and bearing a large keel; apex provided with a large, rounded knob which

bears a sharp, ventral carina; left copulatory piece a thick, somewhat flattened rod whose ventrolateral surface is armed with tiny scales; right piece blunt, its apex obliquely truncate, the left margin rolled and thickened; internal sac with numerous scales, a few apiculate ones near the apex; parameres long, bearing 4 long setae.

Holotype male (U.S.N.M. 65976) and numerous paratypes, Celo Mountain, Yancey Co., North Carolina, 21 Aug. 1960 (TCB/MCB); additional paratypes from Mt. Mitchell, Yancey Co.; Balsam Gap, Buncombe Co., and Pinnacle Mountain, McDowell Co. *Holotype male*: TL 3.86, HL 0.76, HW 0.78, PL 0.80, PW 1.06, EL 2.30, EW 1.69, ANT 1.78.

Distribution: Black Mountains, North Carolina, usually between 5000-5500 feet.

Trechus (*T.*) *cumberlandus* NEW SPECIES
(FIG. 9)

Closely similar to *T. schwarzi* Jeann., differing in the smaller hind angles of the pronotum, the smaller size of the aedeagus, the smaller apical knob, and the nature of the copulatory pieces.

Length 3.4-3.8, mean 3.6. Dark blackish piceous, robust and subconvex, shining. *Head* 1/10 longer than wide; eyes subconvex, their diameter (0.20) slightly greater than length of scape; antenna half body length. *Pronotum* 1/3 wider than long; apex 9/10 width of base; base width 4/5 the maximum width and equal to pronotum length; maximum width at apical 1/4; margins arcuate in apical 1/2 then convergent to very brief basal sinuosity; hind angles moderate, blunt, reflexed and right; smaller than in *schwarzi*. *Elytra* 7/10 as wide as long; longitudinal striae feebly impressed, only inner four complete; apical recurrent groove broad, arcuate, oblique to suture, running into 5th longitudinal stria anterior to apical discal puncture; first discal puncture anterior to level of 4th marginal humeral puncture. *Aedeagus* 1.14-1.24, mean 1.20; of same form as *schwarzi* but less strongly arcuate, apical knob smaller; left copulatory piece rod-like, its ventral edge with small spines; right piece spatulate and truncate, with inconspicuous serrations; parameres with 4 long setae.

Holotype male (U.S.N.M. 65975) and numerous paratypes, Elisha Steele Cave, 3 miles east of Monticello, Wayne Co., Kentucky, 3 Oct. 1959 (TCB and T. S. Treanor); additional paratypes from Jewett Cave, Cumberland Co., Tenn.; Falling Springs Cave, Overton Co., Tenn.; and Savage Gulf, Grundy Co., Tenn. *Holotype male*: TL 3.86, HL 0.80, HW 0.73, PL 0.76, PW 1.02, EL 2.30, EW 1.67, ANT 1.96.

Distribution: All four of the known colonies of *T. cumberlandus* are in the Cumberland plateau, giving a maximum range of about 100 miles.

Incertae sedis

Trechus (*T.*) *dietrichi* NEW NAME
(FIG. 10)

Trechus (s. str.) *Vandykei* Jeannel 1931: 439; nom nov. for *ruficollis* Van Dyke 1926: 66; type in Cornell Univ. coll.

The transfer of *Microtrechus* to *Trechus* has necessitated an unfortunate nomenclatural change involving an inadequately known species named *ruficollis* by Van Dyke and based on 4 specimens in the Crew collection, labeled "Lawrence, Massachusetts." Like Jeannel, I regard the locality label as a curatorial error. I have examined the type and a paratype of

ruficollis Van Dyke (preoccupied by *ruficollis* Putzeys 1870 and consequently renamed by Jeannel) and have not been able to place them in any previously described species, nor do they seem to belong to any known North American species group. The aedeagus of the type (Fig. 10) measures 0.61 mm. in length, is strongly arcuate and attenuate with a blunt tip, lacks a basal keel (probably broken off), and has a heavy, scaly armor on the internal sac, effectively obscuring the transfer apparatus. The dubious honor of having this "lost" species bear his name has been accorded Dr. Henry Dietrich, Cornell University, who was kind enough to lend me the type and permit me to dissect it.

SUBGENUS MICROTRECHUS JEANNEL [NEW STATUS]

Microtrechus Jeannel, 1927: 585; type: *M. Vandykei* Jeannel.

VANDYKEI GROUP, NEW GROUP

Length 2.4-3.3 mm. Integument pale to dark piceous, shining; legs and mouthparts paler. *Head* rounded to slightly wider than long; eyes subconvex or convex, their diameter about equal to length of scape; antenna $2/5$ to $3/5$ body length. *Pronotum* transverse, $1/2$ to $2/5$ wider than long; hind angles small to moderate, usually obtuse and blunt; marginal gutter deep; basal foveae broad and deep. *Elytra* $3/4$ as wide as long, subconvex; inner 3 or 4 longitudinal striae feebly impressed, external striae obsolete; scutellar stria obsolete; apical recurrent groove variable, either short and oblique, or long and subparallel to suture, always running into 5th longitudinal stria anterior to the apical discal puncture; anterior discal puncture placed before level of the 4th marginal humeral puncture (except in *tonitru*). *Aedeagus* more or less strongly arcuate, apically gradually attenuate, tip sometimes slightly reflexed, but never hooked; transfer apparatus of two lamellar copulatory pieces, the left small and triangular, the right large and apically rounded; internal sac armed with very small, blunt or apiculate scales.

Type-species: *T. (Microtrechus) vandykei* Jeannel.

Trechus (Microtrechus) vandykei (Jeannel) [NEW COMBINATION]

(FIG. 11)

Microtrechus Vandykei Jeannel, 1927: 587, figs. 1280-1285; 1931: 443; type: Black Mtns., N.C. (Mus. Nat. Hist. Nat. Paris).

Not *T. (s. str.) Vandykei* Jeannel, 1931: 439, nom. nov. for *ruficollis* VanDyke, 1926: 66.

Distinguished from other species of the group by its smaller size and extremely transverse pronotum, with well-defined hind angles, and by the small, arcuate, thickened aedeagus.

Length 2.4-2.9, mean 2.7. Dark piceous, shining, robust and subconvex. *Head* as wide as long; labrum emarginate; frontal grooves deeply impressed; eyes scarcely convex, their diameter (0.11) subequal to length of scape; antenna $2/5$ body length. *Pronotum* nearly $1/2$ wider than long; apex and base subequal and $7/10$ maximum width, which occurs in apical $1/4$; margins arcuate (posteriorly convergent and less arcuate in certain local populations), basal sinuosity in basal $1/8$; hind angles small, blunt, slightly more than right. *Elytra* $13/20$ as wide as long; inner 3 longitudinal striae feebly impressed, external striae obsolete or obsolescent; apical recurrent groove broad, arcuate at elytral apex, then subparallel to suture, running into trace of 5th longitudinal stria in advance of apical discal puncture; anterior discal puncture slightly before 4th marginal humeral puncture; no scutellar stria. *Aedeagus* 0.43-0.48,

mean 0.46; small, thick, and strongly arcuate in left lateral view; apex blunt, somewhat attenuate, and slightly reflexed; transfer apparatus of two lamellar copulatory pieces, the left short and triangular, nested within larger right piece, the dorsal border of which is rounded and thickened; internal sac armed with very small, apiculate spines; parameres short and thick, bearing 4 or 5 short setae.

Male (Celo Mountain, Yancey Co., N.C., in author's collection): TL 2.93, HL 0.60, HW 0.60, PL 0.58, PW 0.85, EL 1.75, EW 1.13, ANT 1.27.

Distribution: NORTH CAROLINA: Celo Mtn. and Balsam Gap, Yancey Co.; Pinnacle Mtn., McDowell Co.; Mt. Pisgah, Devils Courthouse, Cold Mtn., and Graveyard Fields, Haywood Co.; Tusquitee Bald, Clay-Macon Counties; Cheoah Bald, Joanna Bald, and Haeo Lead, Graham Co.; Whiteside Mtn., Jackson Co. TENNESSEE: Unaka Mtn., Unicoi Co.; Camp Creek Bald, Greene Co. The approximate range is from the Bald and Unaka Mountains of Tennessee, southwestward through the Black, Great Craggy, Great Balsam, and Nantahala Mountains, occurring rather commonly at the lower elevations, but seldom above 5000 feet. Certain demes seem to vary consistently in the degree of reflection of the posterior pronotal angles, the arcuate or convergent margins of the pronotum, the presence or absence of faint external longitudinal striae on the elytra, or the thickness of the aedeagal apex, but such independent variation is not readily correlated with geography, and I have not attempted to subdivide the species.

Trechus (Microtrechus) bowlingi NEW SPECIES

(FIG. 12)

Similar to *vandykei* Jeannel but differing in the less pronounced hind angles of the pronotum, in the larger size and shape of the aedeagus, and in microhabitat preference.

Length 2.6-2.9, mean 2.7. Closely similar to *vandykei*, differing as follows: Eyes larger (0.15), more convex. Pronotal margins convergent, not arcuate in basal half, the basal sinuosity nearly obliterated; hind angles much more obtuse, almost rounded. Elytral longitudinal striae more distinct, disc slightly more depressed. Aedeagus larger (0.65-0.70, mean 0.68); middle portion of median lobe flattened; apex more sharply attenuate and more distinctly reflexed.

Holotype male (U.S.N.M. 65980) and numerous paratypes, Mt. Kephart, Sevier Co., Tennessee-Swain Co., North Carolina, 1 July 1960 (TCB, MCB, Joyce and R. T. Bell); additional paratypes from Great Smoky Mountains National Park as follows: Clingmans Dome, Indian Gap, Sugarland Mountain, Mt. Buckley, Cataloochee Balsam, Old Black, and Mt. Sterling. *Holotype male*: TL 2.89, HL 0.58, HW 0.60, PL 0.58, PW 0.82, EL 1.73, EW 1.18, ANT 1.29.

Distribution: Known only from the spruce-fir forests at high elevations in the Great Smoky Mountains, from 4900 feet to 6600 feet.

Trechus (Microtrechus) barberi (Jeannel) [NEW COMBINATION]

(FIG. 13)

Microtrechus barberi Jeannel, 1931: 444, figs. 55-57; type: Retreat, Haywood Co., N.C. (U. S. Nat. Mus.).

Distinguished from *vandykei* and *bowlingi* by the large body size, the absence of a basal sinuosity in the pronotal margin, and the larger, more attenuate aedeagus.

Length 2.8-3.2, mean 3.0. Dark, blackish-piceous, shining, similar in form to *vandykei* but larger and more robust. *Head* about as wide as long; eye proportionately a little larger and more convex than in *vandykei*, its diameter (0.18) subequal to length of scape; antenna half body length. *Pronotum* $2/5$ wider than long; base and apex subequal, equal to $5/7$ maximum width, which occurs in apical $1/3$; margins arcuate apical half, then convergent, with scarcely any sinuosity, to blunt, slightly obtuse hind angles; basal foveae broad and deep. *Elytra* $3/4$ as wide as long; internal 3 or 4 longitudinal striae feebly impressed, outer striae usually obsolete; apical recurrent groove short, arcuate, then oblique to suture, running into trace of 5th longitudinal stria a short distance before level of apical discal puncture; anterior discal puncture between level of 3rd and 4th marginal humeral punctures. *Aedeagus* 0.64-0.82, mean 0.71; larger, more elongate, and less arcuate than in *vandykei*, apex more attenuate and slightly produced, tip slightly enlarged and reflexed; copulatory pieces as in *vandykei*; parameres more elongate, with 4 long setae.

Male (Richland Balsam, Haywood Co., N.C., in author's collection): TL 3.04, HL 0.64, HW 0.65, PL 0.62, PW 0.89, EL 1.78, EW 1.31, ANT 1.47.

Distribution: Jeannel (1931, p. 445) records *barberi* from the type locality and also from Roan High Knob, Carter Co., Tennessee, both collections made by Hubbard and Schwarz. The species is abundant in the Great Balsam Mountains near Retreat, which Jeannel supposed was near Roan Mountain, but on Roan Mountain only *T. b. beutenmulleri* and *T. roanicus* were encountered in my field work. The type locality is quite probably near Retreat, as stated, but the record from Roan Mountain is certainly a mistake. I have already shown that a similar error—apparently in labeling—was made with respect to *T. schwarzi* Jeannel. The true range of *barberi* appears to be almost as extensive as that of *vandykei*, whose range it overlaps widely, and with which it is often associated. NORTH CAROLINA: Richland Balsam, Rhinehart Knob, Big Sam Knob, Cold Mountain, Devils Courthouse, Graveyard Fields, Mt. Pisgah, Water Rock Knob, and Junaluska Balsam, Haywood Co.; Standing Indian Mountain, and Wayah Bald, Macon Co.; Whitewater Falls gorge and Whiteside Mountain, Jackson Co. TENNESSEE-NORTH CAROLINA: Cataloochee Balsam, Old Black, Mt. Kephart, Sugarland Mountain, Clingmans Dome, and Mt. Buckley, Great Smoky Mountains National Park. GEORGIA: Rabun Bald, Rabun Co.; Brasstown Bald, Union Co. The area occupied by this species is thus about 75 miles long by 50 miles wide, and extends from the vicinity of Asheville, N. C., to northeastern Georgia. In altitude, *T. barberi* ranged from 2400 feet in the Whitewater gorge to 6300 feet on Clingmans Dome.

Trechus (Microtrechus) tonitru NEW SPECIES

(FIG. 14)

Closely similar to *barberi* Jeann., differing in the broadened apex of the pronotum, the unusually long, inflected, apical recurrent groove, sometimes curved at the tip, and the slender, apically inflected and reflexed aedeagus.

Length 2.8-3.2, mean 3.0. Differs from *barberi* as follows: Eyes smaller and less convex. Apex of *pronotum* 1/10 wider than base; hind angles as in *vandykei*, small, blunt, slightly obtuse. *Elytra* rather depressed, often with decided iridescence, with irregular, short, transverse striae; apical recurrent groove much longer than in *barberi*, laterally inflected, often curved at tip toward trace of the 5th longitudinal stria. *Aedeagus* 0.76-0.81, mean 0.79, apex broadly inflected and reflexed at the tip.

Holotype male (U.S.N.M. 65990) and 18 paratypes, Thunderhead, Great Smoky Mountains National Park, Blount Co., Tennessee, 6 July 1960 (TCB/MCB). *Holotype male*: TL 2.84, HL 0.55, HW 0.55, PL 0.58, PW 0.80, EL 1.71, EW 1.22, ANT 1.36.

Distribution: Known only from the type locality, elevation 5530 feet.

Trechus (Microtrechus) subtilis NEW SPECIES
(FIG. 15)

Similar superficially to *barberi* Jeann. but immediately distinguished by the much larger, more elongate aedeagus.

Length 3.1-3.3, mean 3.2. Differs from *barberi* as follows: *Head* slightly wider than long; eye proportionately smaller (diam. 0.16); antenna nearly 3/5 body length. *Pronotum* with base slightly wider than apex; slightly sinuate at margins in basal 1/10. *Aedeagus* 0.85-0.92, mean 0.89; larger, more slender, and less arcuate than in *barberi*, but of same general pattern and with similar transfer apparatus.

Holotype male (U.S.N.M. 65986) and 6 paratypes, Mt. Sterling, Haywood Co., North Carolina, 29 August 1960 (TCB/MCB); one male paratype, Junaluska Balsam, Haywood Co., N.C. *Holotype male*: TL 3.22, HL 0.65, HW 0.71, PL 0.67, PW 0.93, EL 1.90, EW 1.45, ANT 1.86.

Distribution: Known only from the two localities stated, one in the Great Smoky Mountains and the other in the Plott Balsams; rare.

UNCIFER GROUP, NEW GROUP

Length 2.7-4.0 mm. Integument piceous, rather pale, shining. *Head* rounded or slightly wider than long; labrum singly emarginate; eyes small, their diameter equal to or a little less than length of scape; antenna half body length. *Pronotum* transverse, 1/4 to 1/2 wider than long; hind angles small, blunt (except in *verus*); basal foveae either linearly impressed or broadly impressed. *Elytra* 7/10 as wide as long, and 1/3 wider than pronotum; 3 or 4 internal longitudinal striae complete, remainder obsolescent or effaced; recurrent portion of apical groove either parallel to suture or slightly divergent outwardly, ending anterior to apical discal puncture and continuous with trace of 5th longitudinal stria; anterior discal puncture at level of 4th marginal humeral puncture. *Aedeagus* provided with an apical hook or barb, the apex more or less produced; internal sac armed with large, prominent spines (except in *verus*).

Type-species: *T. (Microtrechus) uncifer* n. sp.

Trechus (Microtrechus) uncifer NEW SPECIES
(FIG. 16)

Immediately distinguishable by the produced, barbed aedeagal apex and the extremely large scales of the internal sac.

Length 2.7-3.2, mean 2.9. Pale piceous, shining. *Head* rounded, about as wide as long; labrum evenly and conspicuously emarginate; eye diameter 0.15, subequal to length of scape; antenna half total body length. *Pronotum* transverse, 1½ times as wide as long; apex and base subequal and 7/10 maximum width, which occurs in apical 1/3 just posterior to the level of anterior marginal setae; basal foveae short

and linear; margins broadly arcuate, barely perceptibly sinuate immediately before hind angles, which are small, right, and blunt. *Elytra* 7/10 as wide as long, 1/3 wider than pronotum; first longitudinal striae feeble, outer striae obsolescent to completely absent; recurrent part of apical groove parallel to suture, continuous with trace of 5th longitudinal stria, ending well in advance of apical discal puncture; anterior discal puncture at level of 4th marginal puncture. *Aedeagus* 0.88-1.03, mean 0.97; apex produced into long spine, tip sharply reflexed, having barbed appearance; internal sac armed with oblique rows of unusually large, apiculate scales; parameres with 4 setae.

Holotype male (U.S.N.M. 65992), Clingmans Dome, Sevier Co., Tennessee-Swain Co., North Carolina, 28 June 1960 (TCB); additional paratypes from Clingmans Dome, Mt. Buckley, and Sugarland Mountain, Great Smoky Mountains National Park; and two paratype males from Water Rock Knob, Haywood Co., N.C. *Holotype male*: TL 3.06, HL 0.62, HW 0.64, PL 0.62, PW 0.91, EL 1.82, EW 1.26, ANT 1.45.

Distribution: Known only from altitudes above 5500 feet in the Great Smokies and Plott Balsams.

Trechus (Microtrechus) satanicus NEW SPECIES
(FIG. 17)

Recognized by the extremely elongate, straight aedeagus with large, deflexed basal bulb, spiny internal sac, and apical hook; aedeagus nearly half the body length.

Length 3.2-3.5, mean 3.3. Dark piceous, shining, microsculpture a fine, transverse network on pronotum and elytra. *Head* 1/12 wider than long; labrum shallowly emarginate; eye diameter 0.15, a little less than length of scape; antenna half body length. *Pronotum* 2/5 wider than long; apex, base, and length all subequal, and 0.70-0.75 maximum width, which occurs in apical 1/3; sides convergent, barely perceptibly sinuate before hind angles, which are small, blunt, and slightly obtuse; basal foveae broadly impressed. *Elytra* 7/10 as wide as long, 1/3 wider than pronotum; longitudinal striae 1-4 feebly impressed, 5 obsolescent, external striae effaced; recurrent part of apical groove slightly divergent from suture, continuous with trace of 5th stria, ending well in advance of apical discal puncture; anterior discal puncture at level of 4th marginal puncture. *Aedeagus* 1.47-1.49, mean 1.48; extremely elongate and straight, about 9/20 body length; basal bulb large and sharply deflexed, apex produced, bearing a large, reflexed hook; internal sac armed with very large, apiculate scales obscuring the transfer apparatus; parameres long, with 4 setae.

Holotype male (U.S.N.M. 65985) and 8 paratypes, west end of Graveyard Fields near Devils Courthouse, Haywood Co., North Carolina, 27 May 1961 (TCB); two paratypes from same area, 20 July 1960 (TCB). *Holotype male*: TL 3.33, HL 0.68, HW 0.74, PL 0.67, PW 0.95, EL 1.98, EW 1.37, ANT 1.64.

Distribution: Known only from the type locality, where it is rare. The locality is an open thicket of blackberry bushes 100 yards north of the Blue Ridge Parkway at mile 420.5, approximately a mile east of the Devils Courthouse.

Trechus (Microtrechus) verus NEW SPECIES
(FIG. 18)

Distinguished from other members of the group by its larger size, the pale coloration and small eyes, and by the long, slender aedeagus with broadly hooked apex; no large scales in armature of internal sac.

Length 3.6-4.0, mean 3.7. Pale piceous, shining. *Head* $1/8$ wider than long; eye diameter 0.18, subequal to length of scape. *Pronotum* transverse, $1/4$ wider than long; base and apex $7/10$ maximum width, which occurs at apical $1/3$; sides arcuate, sinuate just before small hind angles, which are right and sharp; basal foveae broad, deeply impressed. *Elytra* $7/10$ as wide as long, convex; $1/2$ wider than pronotum; inner four longitudinal striae feeble, external striae obsolescent or absent; recurrent part of apical groove slightly divergent, ending just anterior to apical puncture, continuous with trace of 5th stria; first discal puncture at level of 4th marginal humeral puncture. *Aedeagus* 0.95-1.02, mean 0.97; rather long and slender, with large basal bulb and sagittal keel; apex abruptly reflexed into large, flattened hook; copulatory pieces subequal in length, the right one thicker and obliquely truncate at tip; scales of internal sac very small; parameres long, with 4 long setae.

Holotype male (U.S.N.M. 65993), one male and two female paratypes, Mt. Sterling, Haywood Co., North Carolina, 29 June 1960 (TCB/MCB); additional paratypes from Clingmans Dome, Sugarland Mountain, Cataloochee Balsam, Old Black, and Mt. Kephart, all in Great Smoky Mountains National Park. *Holotype male*: TL 3.85, HL 0.67, HW 0.75, PL 0.82, PW 1.06, EL 2.36, EW 1.69, ANT 1.84.

Distribution: Known only from the conifer forests of the Great Smoky Mountains, much more common in the deeper layers of moss mats and conifer needle duff, usually in close contact with rock, or under deeply embedded rocks in podzolic humus.

Trechus (Microtrechus) aduncus NEW SPECIES
(FIG. 19)

Distinguished from *uncifer*, which it resembles externally, by the shorter aedeagus with smaller scales of the internal sac and a shorter, more broadly hooked aedeagal apex; total body length slightly greater than *uncifer*.

Length 3.1-3.4. Pale piceous, shining. *Head* rounded, about as wide as long; labrum evenly emarginate; eye diameter 0.14, subequal to length of scape; antenna half total body length. *Pronotum* transverse, $1\frac{1}{2}$ times as wide as long; apex and base subequal and $3/4$ maximum width, which occurs in apical $1/4$ just posterior to level of anterior marginal setae; basal foveae short and linear, expanding into hind angles and continuous with marginal gutter; margins convergent toward base, barely perceptibly sinuate immediately before hind angles, which are small, right, and blunt. *Elytra* $7/10$ as wide as long; longitudinal striae feeble, 1-3 deeper than 4-7; recurrent part of apical groove parallel to suture, continuous with 5th longitudinal stria, ending well in advance of apical discal puncture; anterior discal puncture at level of 4th marginal puncture. *Aedeagus* 0.79-0.81; arcuate, with moderate basal bulb and large sagittal keel; apex slightly produced and expanded into prominent, reflexed hook; parameres with 4 setae; scales of internal sac smaller than in *uncifer*.

Holotype male (U.S.N.M. 65978) and 3 paratypes, Mt. Pisgah, Haywood Co., North Carolina, 13-14 September 1934 (E. R. Quirsfeld); additional paratypes from Mt. Pisgah and Richland Balsam, Haywood Co., N.C. *Holotype male*: TL 3.07, HL 0.64, HW 0.64, PL 0.58, PW 0.85, EL 1.85, EW 1.15, ANT 1.42.

Distribution: Known only from the Great Balsam Mountains, between 4800-6400 feet; comparatively scarce.

Trechus (Microtrechus) talequah NEW SPECIES
(FIG. 20)

Similar to *aduncus*, especially in aedeagal form, but differing in the

smaller size, proportionately smaller eye, shorter apical recurrent groove, and shorter, straighter aedeagus.

Length 2.7-3.0, mean 2.8. Differs from *aduncus* as follows: Eye 0.13, only 0.77 length of scape. Apical groove shorter, its recurrent portion ending just beyond apical discal puncture. *Aedeagus* 0.66-0.73, mean 0.70, about 7/10 length of aedeagus in *aduncus*, basal bulb more strongly bent, middle portion of the median lobe not arcuate, apex scarcely produced, terminal hook as in *aduncus* but somewhat less reflexed.

Holotype male (U.S.N.M. 65987) and 5 paratypes, Haw Knob, Monroe Co., Tennessee, 11 August 1961 (TCB and W. H. Adams); additional paratypes from Haeo Lead, Graham Co., North Carolina, 25 July 1960 (TCB/MCB). *Holotype male*: TL 2.75, HL 0.55, HW 0.58, PL 0.56, PW 0.78, EL 1.64, EW 1.07, ANT 1.37.

Distribution: Known only from the Unicoi Mountains, between elevations of 4800-5000 feet.

NEBULOSUS GROUP, NEW GROUP

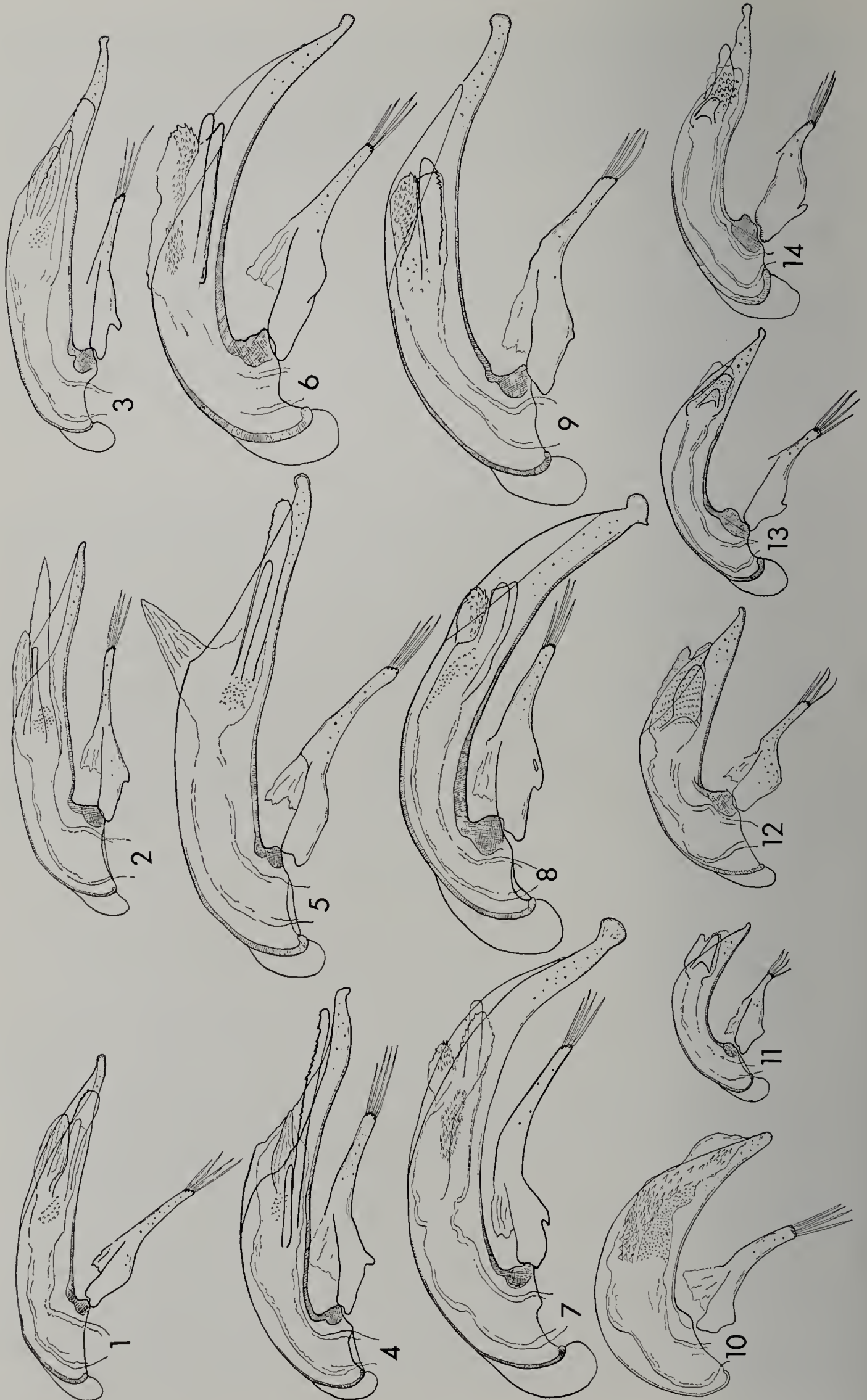
Length 3.3-5.0 mm. Integument black to reddish piceous, shining; microsculpture of pronotum and elytra a very fine, transverse or slightly oblique meshwork (except in *novaculosus*); form robust, convex to subconvex. *Head* slightly wider than long; labrum singly or doubly emarginate; eyes variable, from large and convex to small and flattened; antennae half body length. *Pronotum* transverse, 1/4 to 9/20 wider than long; margins with or without basal sinuosity; hind angles usually sharp, but may be acute, right or obtuse. *Elytra* 7/10 to 3/4 as wide as long; longitudinal striation rather well developed, at least 3 or 4 internal striae complete, but in some species 5 or more complete striae; apical recurrent groove short, usually oblique to suture, running to 5th longitudinal stria; anterior discal puncture variable, at level of 4th marginal humeral puncture or anterior to it; scutellar stria well developed (except in *novaculosus*), but short and deeply impressed. *Aedeagus* strongly arcuate, with large mid-sagittal keel and tapered, reflexed apex; copulatory pieces heavily sclerotized, their structure variable and usually diagnostic of the species; internal sac thickly set with numerous small, blunt or occasionally apiculate scales; parameres with 4 or 5 setae.

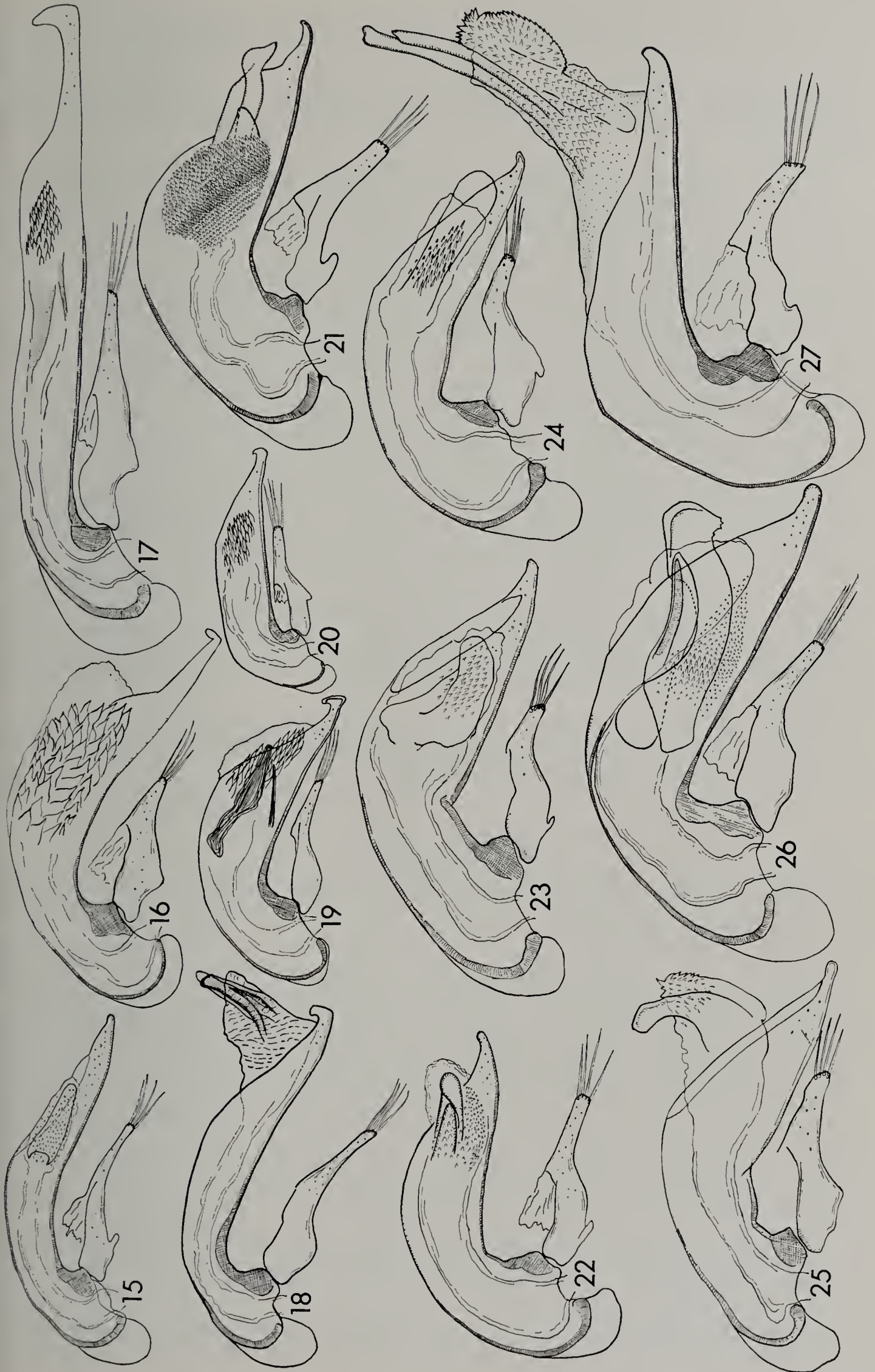
Type-species: *T. (Microtrechus) nebulosus* n. sp.

Explanation for illustrations on following two pages:

FIGURES 1-10. Aedeagi of *Trechus* (s.str.). 1—*hydropicus* Horn; "Va." (U.S.N.M.). 2.—*b. beutenmulleri* Jeannel; Mt. Mitchell, N.C. 3—*b. avus* n. subsp.; Grandfather Mtn., N.C. 4—*b. canus* n. subsp.; White Top Mtn., Va. 5—*roanicus* n. sp.; Roan Mtn., Tenn.-N.C. 6—*carolinae* Schaeffer; Mt. Mitchell, N.C. 7—*schwarzi* Jeannel; Craggy Dome, N.C. 8—*mitchellensis* n. sp.; Celo Mtn., N.C. 9—*cumberlandus* n. sp.; Steele Cave, Ky. 10—*dietrichi* nom. nov.; holotype, Cornell Univ. coll.

FIGURES 11-27. Aedeagi of *Trechus (Microtrechus)*. 11—*vandykei* (Jeannel); Craggy Dome, N.C. 12—*bowlingi* n. sp.; Mt. Sterling, N.C. 13—*barberi* (Jeannel); Richland Balsam, N.C. 14—*tonitru* n. sp.; Thunderhead Mtn., Tenn.-N.C. 15—*subtilis* n. sp.; Mt. Sterling, N.C. 16—*uncifer* n. sp.; Clingmans Dome, Tenn.-N.C. 17—*satanicus* n. sp.; Graveyard Fields, N.C. 18—*verus* n. sp.; Old Black Mtn., Tenn.-N.C. 19—*aduncus* n. sp.; Mt. Pisgah, N.C. 20—*talequah* n. sp.; Haw Knob, Tenn.-N.C. 21—*nebulosus* n. sp.; Old Black Mtn., Tenn.-N.C. 22—*tuckaleechee* n. sp.; Tuckaleechee Caverns, Tenn. 23—*tennesseensis tennesseensis* n. sp. and subsp.; Berry Cave, Tenn. 24—*balsamensis* n. sp.; Water Rock Knob, N.C. 25—*luculentus* n. sp.; Clingmans Dome, Tenn.-N.C. 26—*rosenbergi* n. sp.; Water Rock Knob, N.C. 27—*novaculosus* n. sp.; Clingmans Dome, Tenn.-N.C.





Trechus (Microtrechus) nebulosus NEW SPECIES
(FIG. 21)

Immediately distinguished from other members of the group by the right copulatory piece, the apex of which is twisted into the shape of a bird's head.

Length 2.3-4.0, mean 3.7. Black to dark piceous, disc of the pronotum and antennal segments III-V slightly darker; form robust and subconvex. *Head* slightly wider than long; labrum only shallowly emarginate; eyes small (diam. 0.18) and convex; antenna nearly half body length. *Pronotum* $2/5$ wider than long; apex $9/10$ as wide as base width, and $9/10$ maximum width, which occurs in apical $1/3$; margins arcuate in apical half, then convergent posteriorly, with no sinuosity, to hind angles, which are large, blunt, obtuse, and reflexed; basal foveae broad and deep. *Elytra* $3/4$ as wide as long; inner 3 or 4 longitudinal striae complete, sutural stria lightly and irregularly punctulate, external striae obsolescent and barely traceable; apical recurrent groove broad, short, and oblique to suture, running to 5th longitudinal stria or juncture of the 5th, 6th, and 7th, ending a short distance anterior to apical discal puncture; scutellar stria short but deep and prominent; anterior discal puncture between level of the 3rd and 4th marginal humeral punctures. *Aedeagus* 0.98-1.03, mean 1.01; large, thick, and strongly arcuate, apex gradually attenuate, blunt, and slightly reflexed; copulatory pieces heavily sclerotized, the left triangular and nested in the right piece, which is $1/3$ longer and has apex completely twisted and folded into a lamina resembling the head of a bird; internal sac thickly set with oblique rows of heavy, blunt scales; parameres large and thick, with four long setae.

Holotype male (U.S.N.M. 65982) and 10 paratypes, Mt. Kephart, Sevier Co., Tennessee, 1 July 1960 (TCB, MCB, Joyce and R. T. Bell); additional paratypes from Clingmans Dome, Mt. Buckley, Indian Gap, Newfound Gap, and Old Black, Great Smoky Mountains National Park. *Holotype male*: TL 3.82, HL 0.71, HW 0.75, PL 0.77, PW 1.06, EL 2.34, EW 1.69, ANT 1.82.

Distribution: Known only from high altitudes (5000-6300 feet) along the crest of the Great Smoky Mountains.

Trechus (Microtrechus) tuckalcechee NEW SPECIES
(FIG. 22)

Similar to *nebulosus* but differing in the sinuate margins of the pronotum, the larger size, smaller eyes, smaller aedeagus, and the rounded apex of the right copulatory piece.

Length 3.7-4.3, mean 4.0. Reddish piceous, brilliantly shining; form robust and subconvex. *Head* slightly wider than long; labrum shallowly and singly emarginate; frontal grooves broad and deep; eyes small (diam. 0.15) and subconvex but otherwise normal; antenna half body length. *Pronotum* $1/4$ wider than long; apex $1/20$ less than width of base, which is $3/4$ maximum width; maximum width at apical $1/4$; margins arcuate with a noticeable sinuosity in the basal $1/7$, hind angles sharp, subquadrate, and lightly reflexed; basal foveae broad and deep, separated from the marginal gutter by a low ridge; disc medially flattened, with very fine, transverse microsculpture. *Elytra* $3/4$ as wide as long; longitudinal striation feeble, but all striae distinguishable, becoming shallow externally and faintly punctulate; apical recurrent groove short, running into 5th longitudinal stria at level of apical discal puncture and slightly oblique to suture; scutellar stria short but deep and prominent; anterior discal puncture between level of 3rd and 4th marginal humeral punctures. *Aedeagus* 0.85-0.90, mean 0.87; similar to that of *nebulosus* but smaller; copulatory pieces similar, heavily sclerotized, but the right piece with apex a rounded knob; right piece $1/3$ longer than left piece.

Holotype male (U.S.N.M. 65991) and numerous paratypes, Tuckaleechee Caverns, Blount Co., Tennessee, 25 August 1960 (TCB/MCB);

additional paratypes 18 April 1959 (TCB). *Holotype male*: TL 3.95, HL 0.73, HW 0.75, PL 0.80, PW 1.02, EL 2.42, EW 1.76, ANT 2.02.

Distribution: Known only from the type locality, a large stream cavern in Tuckaleechee Cove, at the west base of the Great Smoky Mountains.

Trechus (Microtrechus) tennesseensis tennesseensis

NEW SPECIES AND SUBSPECIES

(FIG. 23)

Closely similar to *T. tuckaleechee*, differing in the acute posterior angles of the pronotum, the position of the anterior discal puncture, the larger aedeagus, and the slender, subequal copulatory pieces.

Length 4.0-4.3, mean 4.1. Reddish piceous, brilliantly shining, form robust and subconvex. *Head* slightly wider than long; labrum shallowly and singly emarginate; frontal grooves broad and deep; most specimens with a pair of internal clypeal grooves in addition to lateral continuations of the frontal grooves onto clypeus; eyes small (diam. 0.15), flattened, less than length of scape; antenna half body length. *Pronotum* as in *tuckaleechee*, but basal sinuosity more pronounced, hind angles sharp and acute. *Elytra* as in *tuckaleechee*, but scutellar stria much weaker, and anterior discal puncture at or slightly behind level of 4th marginal humeral puncture. *Aedeagus* 1.02-1.07, mean 1.05; similar to that of *nebulosus* and larger than that of *tuckaleechee*; copulatory pieces subequal, slender, and arcuate.

Holotype male (U.S.N.M. 65989) and 27 paratypes, Berry Cave, Roane Co., Tennessee, 30 August 1957 (TCB and B. C. Stewart). *Holotype male*: TL 4.11, HL 0.73, HW 0.78, PL 0.82, PW 1.06, EL 2.56, EW 1.84, ANT 2.14.

Distribution: Known only from the type locality in the Appalachian valley, a cave 8 miles south of Kingston and ¼ mile west of the Tennessee River at mile 578.4, on the southeast side of a valley east of Huckleberry Ridge, at an elevation of 840 feet.

Trechus (Microtrechus) tennesseensis tauricus NEW SUBSPECIES

Differs from *tennesseensis* s. str. as follows: Labrum faintly trilobate, i.e., doubly emarginate, in most specimens; clypeus without internal grooves; external longitudinal striae of elytra obsolescent. Aedeagus with no appreciable differences.

Holotype male (U.S.N.M. 65988) and 9 paratypes, Bull Cave Sinkhole, Blount Co., Tennessee, 25 August 1960 (TCB/MCB).

Distribution: Known only from the type locality. Bull Cave is located just inside the boundary of Great Smoky Mountains National Park near the Cades Cove Entrance, where the road between Tuckaleechee Cove and Cades Cove passes through Rich Mountain Gap, at an approximate elevation of 1800 feet.

Trechus (Microtrechus) balsamensis NEW SPECIES

(FIG. 24)

Closely similar to *nebulosus*, differing in the slightly wider head, larger and more convex eyes, more sharply defined posterior pronotal angles, and the scoop-shaped copulatory pieces.

Length 3.6-3.9, mean 3.7. *Head* slightly wider than long, more so than in *nebulosus*; eyes slightly larger (diam. 0.20) and more convex. *Pronotum* 9/20 wider than long;

apex $9/10$ width of base; base width only $7/10$ maximum width, which occurs in apical $1/3$; margins convergent in basal half, with feeble sinuosity in basal $1/20$ only; hind angles small, sharp, and subquadrate. *Elytra* $3/4$ as wide as long; inner 3 or 4 striae feebly impressed, external striae obsolescent; intervals with very faint, irregular rows of micropunctures; microsculpture a very fine, transverse meshwork; apical recurrent groove short, oblique to suture, ending a short distance anterior to apical discal puncture; anterior discal puncture between levels of 3rd and 4th marginal humeral punctures; scutellar stria very short but deep. *Aedeagus* 0.93-1.05, mean 0.98; of the same general size and shape as *nebulosus*, but apex much broader in dorsal view; copulatory pieces broad, scoop-shaped, the right piece much larger; parameres with 4 or 5 setae.

Holotype male (U.S.N.M. 65979) and 22 paratypes, Water Rock Knob, Haywood-Jackson Counties, North Carolina, 20 July 1960 (TCB/MCB). *Holotype male*: TL 3.74, HL 0.73, HW 0.77, PL 0.73, PW 1.06, EL 2.28, EW 1.69, ANT 1.85.

Distribution: Known only from the type locality, Water Rock Knob, in the Plott Balsam Mountains, at an elevation of 6200 feet.

Trechus (Microtrechus) luculentus NEW SPECIES

(FIG. 25)

Distinguished by its larger size, well-defined, rectangular posterior pronotal angles, the position of the anterior discal seta, and the structure of the transfer apparatus.

Length 3.7-4.4, mean 4.0. Dark, blackish piceous, shining; form robust and convex. *Head* $1/8$ wider than long; labrum evenly emarginate; eyes large and very convex, their diameter (0.24) $1/5$ greater than length of scape; antenna half body length. *Pronotum* $2/5$ wider than long; apex slightly less than width of base; base width $7/10$ maximum width; maximum width in apical $1/3$; margins convergent in basal half, distinctly sinuous at basal $1/9$, then subparallel; hind angles small, sharp, and subquadrate; basal foveae deep and linear, connected to marginal gutter. *Elytra* $3/4$ as wide as long; inner 5 longitudinal striae weakly developed, external striae obsolescent; intervals with irregular rows of faint micropunctures; apical recurrent groove short, broad, oblique to suture, ending at terminus of 5th longitudinal stria just anterior to apical discal puncture; anterior discal puncture placed anterior to level of 4th marginal humeral puncture; scutellar stria short and deep. *Aedeagus* 0.63-0.73, mean 0.68; left copulatory piece very small, rod-like, nested at base of the much larger, lobate right piece, both pieces curved sharply to the right in dorsal view; apex rather short and blunt in dorsal view, not produced; parameres with 4 setae.

Holotype male (U.S.N.M. 65981) and 8 paratypes, Clingmans Dome, Swain Co., North Carolina, 21 May 1961 (TCB); additional paratypes from Clingmans Dome in June and July, 1960. *Holotype male*: TL 3.98, HL 0.76, HW 0.86, PL 0.82, PW 1.13, EL 2.40, EW 1.80, ANT 2.02.

Distribution: Known only from the type locality and from Haw Knob and Laurel Top, in the Unicoi Mountains, Monroe Co., Tennessee, and Graham Co., North Carolina; scarce. There are minor differences between the populations from the Smokies and from the Unicois, but I have only 5 specimens from the latter area and do not wish to base a subspecific diagnosis on so small a sample. The species occurred at 6300 feet on Clingmans Dome and between 5200-5400 feet in the Unicoi Mountains.

Trechus (Microtrechus) rosenbergi NEW SPECIES
(FIG. 26)

Distinguished by its unusually large size and distinctive transfer apparatus.

Length 4.5-5.0, mean 4.7. Form unusually large, robust, convex; blackish-piceous, shining. *Head* slightly longer than wide; labrum shallowly and somewhat irregularly emarginate; eyes small and subconvex, their diameter (0.18) $1/5$ less than length of scape; frontal grooves narrowly incised, becoming broad and shallow as they continue onto clypeus; antenna half body length. *Pronotum* $2/5$ wider than long; apex $1/20$ less than width of base, which is equal to $7/10$ maximum width; maximum width at apical $1/3$; margins convergent in basal half to the slight sinuosity in basal $1/10$; hind angles small, sharp, slightly obtuse, and broadly reflexed; basal foveae broad and shallow, with scarcely any ridge separating them from marginal gutter. *Elytra* $7/10$ as wide as long; at least internal 5 longitudinal striae developed and lightly punctulate, external striae obsolescent but usually traceable; apical recurrent groove broad, short, oblique to suture, running into 5th longitudinal stria a short distance in advance of apical discal puncture; anterior discal puncture at level of 4th marginal humeral puncture. *Aedeagus* 1.21-1.27, mean 1.24; of the general form typical of the group; copulatory pieces heavily sclerotized, the left elongate with pointed apex, nested in base of the right piece, which is $1/5$ longer and has an expanded, hatchet-shaped apex bearing ventrally two small teeth; parameres large but proportionately rather slender, bearing 4 or 5 setae.

Holotype male (U.S.N.M. 65984) and 21 paratypes, Water Rock Knob, Haywood-Jackson Counties, North Carolina, 20 July 1960 (TCB/MCB); one male and one female paratype, Richland Balsam, Haywood Co., North Carolina, August 1960 (TCB). *Holotype male*: TL 5.00, HL 0.95, HW 0.91, PL 0.95, PW 1.33, EL 3.10, EW 2.18, ANT 2.46.

Distribution: Known only from the two stated localities, at altitudes above 6000 feet. It is a great pleasure to name this species, the largest of all southern Appalachian *Trechus*, in honor of Mr. William Rosenberg, Balsam, North Carolina, whose knowledge of the coleopterous fauna of the Plott Balsams is unsurpassed.

Trechus (Microtrechus) novaculosus NEW SPECIES
(FIG. 27)

A species of large size, distinguished from *luculentus*, which it resembles, by the convergent margins of the pronotum; the unusually large posterior pronotal angles; the narrow, produced aedeagal apex (dorsal view); and the thin, extremely elongate, razor-shaped copulatory pieces.

Length 4.2-4.7, mean 4.4. Piceous, brilliantly shining; form robust and subconvex. *Head* $3/20$ wider than long; labrum broadly and shallowly emarginate; eyes small and subconvex, their diameter (0.20) $1/10$ less than length of scape; antenna half body length. *Pronotum* $1/3$ wider than long; apex less than $9/10$ width of base; base width only $3/4$ maximum width, which occurs in apical $3/10$; margins strongly convergent posteriorly, no trace of a sinuosity; hind angles sharp, broadly reflexed, and slightly obtuse; basal foveae broad and deep. *Elytra* $3/4$ as wide as long; most longitudinal striae feebly impressed and faintly punctulate; apical recurrent groove broad, slightly oblique to suture, and short, ending just anterior to apical discal puncture at level of 4th marginal humeral puncture; marginal humeral series crowded; scutellar stria obsolete. *Aedeagus* 1.22-1.24, mean 1.23; apex produced and (in dorsal view) narrow; copulatory pieces extremely narrow and very elongate, the left razor-like, its apical border obliquely-sinuately truncate, the right piece slightly longer with rounded, folded apex; parameres with 4 setae.

Holotype male (U.S.N.M. 65983) and 9 paratypes, Clingmans Dome, Swain Co., North Carolina, 21 May 1961 (TCB); two paratypes from Clingmans Dome, July, 1960. *Holotype male*: TL 4.33, HL 0.78, HW 0.89, PL 0.91, PW 1.22, EL 2.64, EW 1.80, ANT 2.20.

Distribution: Known only from the type locality, where it was collected at an elevation of 6300 feet; scarce.

DISCUSSION

Species of *Trechus* s. str. occur, for the most part, north of the French Broad River, while those of *Microtrechus* occur south of the river. That this boundary is only approximate is indicated by the presence of *T. (Microtrechus) vandykei* in the Great Craggy, Black, and Bald Mountains, and by *T. (T.) schwarzi* in the Great Balsams. The more widely distributed species—*beutenmulleri* and *vandykei* in the north and *barberi* and *vandykei* in the south—are the only *Trechus* known from the Nantahala Mountains, the Blue Ridge proper, and adjacent, somewhat disconnected, upland areas. The local endemics are found in six massifs previously described—Roan Mountain, the Black-Great Craggy Mountains, the Great Balsam Mountains, the Plott Balsam Mountains, the Great Smoky Mountains, and the Unicoi Mountains.

In order to obtain a comparative measure of the degree of endemism in these six areas, the following scheme has been adopted. In Table 1 the "endemic sum" is computed by adding 1.0 for each strict endemic and 0.5 for each species known only from two adjacent ranges. The last column is the quotient of the endemic sum and the total number of species of *Trechus* found in the respective mountain range times 100 per cent. The "approximate length" of the massifs are lengths of the main crests, measured from 1:250,000 topographic maps. The table shows two important things: (1) the endemic species are, with the exception of the Unicoi Mountains (which have a lower endemic index), limited to the higher ranges, each with several peaks over 6000 feet in elevation; (2) there is an approximate correlation between the extent of the range and the number of endemics. Thus the Great Smokies, with a crest length of more than 50 miles, have an endemic sum of 6 ($5+2/2$) out of a total of 8 species (cavernicole species not included), and Roan Mountain, only 6 miles long at the crest, has only two species, one of which is endemic.

Species clusters of surprising complexity, as described in the present paper, are not unusual in *Trechus* (cf. Jeannel 1927), but have been previously unknown in North America. It seems reasonable to speculate that winglessness, a burrowing habit, and restriction to cold, wet microenvironments greatly reduce the mobility of a beetle population. The climatic changes in the southern Appalachians during the Pleistocene must have alternately lowered and raised the altitudinal zone within which favorable *Trechus* niches were found, in effect alternately opening and closing avenues of dispersal. Such a mechanism can be invoked to explain the allopatric distribution of pairs of closely related species such as *uncifer-satanicus*, *aduncus-talequah*, *balsamensis-luculentus*, and *schwarzi-cumberlandus*. Adaptation to at least two rather different microenvironments—moss carpets and deep humus—is clearly indicated by both morphology

and ecology, the deep humus species tending toward larger size, paler coloration, a proportionately narrower head, smaller eyes, and more fully developed elytral striation.

In the cavernicole species *T. cumberlandus*, from the Cumberland plateau of Tennessee and Kentucky, we have an example of how caves may be colonized by trechines from a montane, Appalachian source. The relatives of *cumberlandus* are concentrated in the Blacks and Great Craggies. The distribution of *cumberlandus* coincides almost exactly with that of the *robustus* group of *Pseudanophthalmus*, four species of eyeless trechines which occupy caves at the western margin of the same plateau. Jeannel (1949) has suggested that the cave systems of the Interior Lowlands and Cumberland plateau were populated by successive waves of ancestral forms spreading outward from the Appalachians in periods of glacial advance and retreating into caves during the interglacials. If this hypothesis be correct, we may have in the distribution of *T. cumberlandus* the repetition of a pattern of cave colonization which can help clarify the existing distribution of cave trechines. *T. tennesseensis* and *T. tuckaleechee* probably share a common ancestry with *balsamensis* and *luculentus* because of the generally similar transfer apparatus. They occupy caves much closer to the Appalachians, in an area close to the Great Smokies but devoid of troglotic trechines.

TABLE 1. ENDEMISM IN SOUTHERN APPALACHIAN TRECHUS

Range	Approximate Length (Miles)	Total Species	Endemic Sum	Endemic Index
Great Smoky Mountains	50	8	6.0	75%
Great Balsam Mountains	35	6	3.0	50%
Black and Great Craggy Mountains	20	5	2.5	50%
Unicoi Mountains	20	4	1.5	38%
Plott Balsam Mountains	15	5	2.5	50%
Roan Mountains	6	2	1.0	50%

LITERATURE CITED

- BARR, THOMAS C., JR.
1961. A one-step clearing and mounting technique for male genitalia in Coleoptera. *The Coleopterists' Bull.* 15: 7-8.
- CASEY, T. L.
1918. Observations on the American Pogoninae, including *Trechus*. *Memoirs on the Coleoptera VIII*, pp. 394-412.
- DARLINGTON, P. J., JR.
1943. Carabidae of mountains and islands: Data on the evolution of isolated faunas, and on atrophy of wings. *Ecol. Monogr.* 13: 37-61.
- JEANNEL, RENÉ
1927. Monographie des Trechinae. Monographie comparée et distribution géographique d'un groupe de Coléoptères (2^e livraison). *L'Abeille* 33: 1-592.
1931. Révision des Trechinae de l'Amérique du Nord. *Arch. Zool. exp. et gén.*, 71: 403-499.
1949. Les coléoptères cavernicoles de la région des Appalaches. *Notes Biopéologiques*, fasc. 4, *Publ. Mus. Nat. Hist. Nat. (Paris)*, no. 12: 37-104.

PUTZEYS, J. A. A. H.

1870. *Trechorum oculatorum* monographia. Stettiner Ent. Zeitung 31: 7-48, 145-201.

SCHAEFFER, CHARLES

1901. Synopsis of the species of *Trechus*, with the description of a new species. Bull. American Mus. Nat. Hist. 14: 209-212.

VAN DYKE, E. C.

1926. New species of Carabidae. Pan-Pacific Ent. 2: 113-126.

TWO NEW SPECIES OF HYMENORUS (COLEOPTERA: ALLECULIDAE) FROM PANAMA

By J. M. CAMPBELL^{1, 2}

On a recent collecting trip to Panama³, I obtained specimens of two new species of *Hymenorus* Mulsant by beating small dwarfed oak trees that were heavily covered with several species of lichens. Upon further investigation it was found that the beetles were concealed under the lichens, upon which they were apparently feeding. It is of interest to note that three additional species of Alleculidae (two species of *Lobopoda* Solier and *Pseudocistela decepta* Champion) were also collected in this habitat with the species of *Hymenorus*.

Champion (1888-1893) described 39 species of the genus *Hymenorus* in the *Biologia Centrali-Americana*. Of these, only *Hymenorus americanus* Champion was recorded from south of Guatemala. However, Pic (1924, 1930, and 1931) described three species of *Hymenorus* from Brazil. It seems probable that the genus ranges throughout Central America, the scarcity of records being accounted for by the small size, dull coloration, and secretive habits of the beetles.

Champion's work does not include a key to the Central American species of *Hymenorus*, and it would be extremely difficult, if not impossible, to construct a really functional key without examining all of his material. The following key, based in large part on Champion's specific descriptions, in the *Biologia Centrali-Americana*, is designed to separate the two new species described herein from all other Central American species, which are, for the sake of brevity, referred to by the numbers assigned them by Champion. The groups of species delineated in the key are not to be interpreted as necessarily natural in the taxonomic sense.

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|----|---|----------------------|
| 1. | Eyes of both male and female separated by a distance equal to or greater than the width of an eye ----- | 3 |
| | Eyes of male or female separated by a distance less than the width of an eye ---- | 2 |
| 2. | Apex of male genitalia trilobed; sides of pronotum broadly rounded from near base to center of apex ----- | HYMENORUS PANAMENSIS |

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